

THE CHANGING FACE OF CALIFORNIA BOTANY

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ABSTRACT

Botany in California has already gone through several faces, and is changing still. The first face was the folk knowledge held by the original inhabitants, largely obliterated during subsequent periods. The first century of European exploration resulted in specimens being deposited in European herbaria, clearinghouses for Linnaeus and subsequent experts. This shifted in the mid-nineteenth century, when the United States annexed the western half of the continent. Specimens collected as part of army-assisted territorial and state surveys now flowed to Torrey and Gray in the eastern United States. By the turn of the century, however, resident botanists in California began to resist Eastern hegemony and to establish their own networks of collaborators. The continued inclusion of numerous amateurs in these networks helped to counter the growing tide of professionalization that was otherwise changing the Face of Academic Botany. Instead, "professional" and "academic" are no longer synonymous, such that there are now more botanists employed by government agencies than by academic institutions in California, primarily because of the increased interest in endangered species. The latest face of California Botany is therefore that of a developing partnership between academic botanists, non-academic professionals, and native plant enthusiasts.

The topic of this paper, "The Changing Face of California Botany", is two-fold. On one hand, "The Changing Face" refers to various stages in the historical development of botany in California. This in turn leads to the second aspect, a summary of the currently developing "New Face of California Botany", which is itself a result of the interplay of two threads. One thread is the historical development of botany as a formalized, professional science, the province of academia. The other thread is the concept of botany as the cultural knowledge of plants that is the province of the general population.

In this latter sense, the first experts on the California flora were the Ohlone, Miwok, Wintu, and other manifold tribes that originally occupied the region now called California. Each tribe knew the flora of its territory intimately, as the source of food, fibers, medicine, and many other essentials of life (Blackburn and Anderson 1993). As in the rest of the world, the first Face of Botany was therefore not a specialized branch of learning belonging only to an elite intelligentsia. Taxonomic and floristic information was part of the essential cultural heritage of a society, amassed and transmitted orally over the span of uncounted generations.

As an ironic result, the Great Period of Exploration of the Cali-

ifornia Botany by western Science was actually a period of net *loss* of knowledge of the California flora, as the indigenous cultures were decimated and their knowledge was destroyed. This point was brought home to me when a reporter asked if the Indians had any uses for the Shasta snow-wreath, and I realized that, even though the species had just been “discovered”, the local tribes undoubtedly had been familiar with the shrub and very probably had some use for it about which we will never know.

Western science began the long process of learning the California flora from the seeds and pressed plants sent back in the 1700’s and 1800’s by European exploring expeditions, seeking profitable trade items and lands to claim. During this period even the coast of California was a long, long way from centers of Western civilization. The Panama Canal did not exist, so the entire coast of South America was more accessible than was western North America. It wasn’t until Spanish missions and British trading posts had been established along the Pacific Coast of North America that more extensive botanical expeditions were possible, by such well-known collectors as David Douglas from Scotland, and Thomas Nuttall, an Englishman working out of Philadelphia and Harvard (McKelvey 1955).

Nuttall was anomalous in that he both collected and described his own material. This was contrary to the dominant pattern initiated by Linnaeus, who depended on the steady stream of novelties collected by his disciples and correspondents from around the globe. This system of an institution-based expert providing a clearinghouse for a network of field-based contributors proved to be very effective, and occurs as a repeatedly appearing pattern. The logic here is that plant exploration requires covering vast areas, generally far from population centers, but the analysis of the resultant collections requires the resources of a major herbarium, with abundant comparative material and library facilities. The initial cataloguing of the New World flora therefore occurred as a function of on-site collectors sending specimens to the great herbaria in Europe, and this is why the types of so many Californian plants are to be found in Great Britain, Switzerland, France, Germany, Spain, Russia, and the Czech Republic.

The first United States expedition to California didn’t occur until 1841, as part of a sea-based exploration under the command of Charles Wilkes. The abundant biological and anthropological specimens collected by the Wilkes expedition throughout the Pacific Basin are what triggered the establishment of the Smithsonian Institution. One of the plant novelties discovered in California was *Darlingtonia*, the cobra lily.

On the heels of the Wilkes expedition were three U.S.-sponsored overland expeditions led by John Charles Fremont, who had been trained by John Torrey in plant collecting techniques. Fremont, one

of the more colorful personalities in the history of the western United States, is better known as an instrumental figure in the seizure of California from Mexico, eventually becoming a senator and presidential candidate.

This marks the beginning of a major transition, intertwined with the United States' vision of Manifest Destiny. In fact, the driving force behind the aforementioned expeditions was less a spirit of scientific inquiry than a necessary precursor for expansionism. The discovery of gold in California (including some on Fremont's property) made an already swelling tide of immigration from the existing United States unstoppable. By the time the dust settled, the United States spanned the continent, including territory formerly claimed by Great Britain, Mexico, Spain, France, and even Russia (not to mention the uncounted Native Americans).

The impact of American expansionism on California botany took several forms. First was an increase in government-sponsored surveys. From our current perspective, it is somewhat a surprise to realize that many of these were army projects. In addition to surveys of newly established borders, the need to keep the expanded nation united spurred a series of expeditions to survey potential railroad routes. Thanks in large part to pressure on Washington exerted by Torrey and Gray, most surveys incorporated a botanical component, or at least allowed a botanist to accompany them and thereby take advantage of the military protection provided (McKelvey 1955).

The sporadic collecting in disputed or unclaimed territory before 1850 therefore gave way to a new face, that of major government-funded expeditions surveying newly annexed lands. This included state as well as federal activities; the new state of California, for example, established a State Geological Survey in the 1860's (Farquhar 1966). The underlying justification was to discover where the gold was, but a major botanical survey was accomplished at the same time by William Brewer and his successor Henry Bolander. One result was the first flora written for a western state (Brewer et al. 1876, Watson 1880).

Another aspect of the new face was that specimens collected on both national and state surveys during this period flowed no longer to Europe, but to respected botanists at established herbaria in the eastern United States. Asa Gray's influence grew as his mentor Torrey's waned, and for nearly 30 years Gray's hegemony dominated American botany (Dupree 1959). This, however, was already changing to yet another New Face by the time of Gray's retirement in 1873.

The most significant break from Gray's former hegemony came from the West itself, where the population had (again) grown to the point of supporting resident botanists. Although the great eastern botanical institutions at Harvard, New York, Washington, and Mis-

souri jostled to divvy up North America among themselves, paralleling European colonialism of previous centuries, autonomous centers had already begun to develop in California. As early as 1853, the California Academy of Sciences was established by a group of resident scientists, including botanist Albert Kellogg. Although some of his novelties were sent to Torrey and Gray for publication, Kellogg described several new species himself.

Kellogg was overshadowed in this regard by Edward Lee Greene, the first professor of botany at the University of California following its establishment in 1868 (Constance 1978). Greene, at the forefront of dissidents against Gray's hegemony and Eastern domination of Western botany, fought vitriolically, not only with Gray but with other Californian botanists, such as Katharine and Townshend Brandegee.

When Greene took a position on the East Coast (unfortunately taking his herbarium with him, now at Notre Dame), he was succeeded by his first student, Willis Linn Jepson, who continued as Professor of Botany for over 40 years. Jepson himself represented a new face of western botany, in that he was a native Californian, with a native's love of the region extending well beyond mere professional interest. Jepson claimed hegemony over California, established Berkeley as a clearinghouse, and developed his own network of contributors and collaborators.

Overlapping Jepson's period of activity, primarily floristic in nature, was a major new development, the evolution of the current face of academic botany. This was "the New Botany", championed by Charles Bessey, with the goal of creating a true science of botany, characterized by explicitly objective and experimental methodologies comparable to those being developed in other scientific disciplines. Within academia, the field blossomed; where "botany" had once been synonymous with plant collection and classification, it now expanded to include what would become the subdisciplines of plant anatomy, physiology, genetics, and ecology.

Plant taxonomy became plant systematics, marked by the repeated introduction of new techniques offering increased precision, rigor, and objectivity. The first major step in this direction was actually pioneered in California, where the seminal experiments in biosystematics were carried out by Jens Clausen, David Keck, and William Hiesey (1940). Cytogenetics followed, and then chemotaxonomy. Computers triggered the development of phenetics and cladistics, both pre-adapted to handle the wealth of point-data now being generated by a diversity of molecular techniques.

The professionalization of botany within academia has been an essential step in establishing botany as a legitimate science, and the New Systematics has generated answers to questions that had previously proved intractable. However, the priorities of the New Systematics put a limit on how much time a modern systematist in

academia can devote to such time-consuming activities fundamental to basic taxonomy as general botanical exploration, specimen collecting and identification, preparing monographs and floras, learning the local flora, and annotating herbarium specimens.

On the other hand, plant taxonomy in the strict sense has never existed as an exclusively academic pursuit. Even Linnaeus depended on an extensive network of field-based contributors, a pattern that appeared repeatedly. In fact, the perception of botany as a professional academic activity is a relatively recent phenomenon, a corollary of New Botany. This is the subject of Elizabeth Keeney's (1992) book, *The Botanizers*, as described in these quotes:

In the years following the Civil War, two changes occurred that would have a dramatic impact on amateur botanizers: the historic patterns of information flow that had kept amateurs within the botanical community eroded, and the type of science pursued by amateurs was no longer that pursued by the mainstream of professionals . . . This development was by no means confined to botany, but rather was part of the normal process of professionalization, occurring across the disciplines; increasingly, those who saw themselves as professionals sought to set themselves apart and to establish their social position by preempting information and by claiming expertise. [p. 123]

The New Botany became the body of knowledge and techniques in which only professional botanists were expert, giving them the authority and autonomy that distinguished them both from amateurs and from other professionals in the life sciences. Only professional botanists were members of the 'ongoing community of inquiry' delineated by the New Botany. It defined the discipline in a way that promoted professionalization and discouraged amateur participation. [p. 149]

Although the schism between professional and amateur as described in *The Botanizers* is relatively accurate for plant sciences in general, in taxonomy the situation is neither as well-defined nor particularly straight-forward, especially in the western United States. Botanizing has continued to flourish outside of academia, in the form of numerous Native Plant Societies and conservation organizations, such that the membership of the California Native Plant Society far exceeds that of the California Botanical Society. Even within academia, the dichotomy between professional and botanizer is not clear-cut, in that much of the basic taxonomy still being done under the aegis of academia has personal satisfaction rather than professional advancement as a reward.

In California, non-academic botanizers have therefore never been completely isolated from professional taxonomists. Jepson, for ex-

ample, cultivated botanizers as part of his network, as did subsequent curators. Alice Eastwood at the California Academy of Sciences likewise encouraged the involvement of amateurs, and her protege John Thomas Howell continued to provide an outlet for the taxonomic contributions of amateurs.

Even more significant, however, is the fact that “professional” and “academic” are not synonymous. In fact, this currently developing new face of California botany represents a change as fundamental as that triggered by Bessey’s *New Botany*, that of a collaborative partnership between academia, non-academic professionals, and talented amateurs.

As evidence for this statement, there are now more botanists in California working for various federal and state government agencies than there are in academic positions. The U.S. Forest Service alone employed 24 full-time and 60 seasonal botanists in California as of 1993 (J. Shevock, personal communication); add to this the increasing number of botanists working for the U.S. Fish and Wildlife Service, the Bureau of Land Management, and the California Department of Fish and Game (which includes the Natural Diversity Database). Nor should one overlook the increasing number of talented botanists employed by the private sector, primarily environmental consulting firms.

This changing face is both a cause and a result of an awareness of environmental issues, primary involving endangered species. Suddenly everyone is obligated to pay attention to rare taxa, with the result that basic plant taxonomy is now **RELEVANT**. Gone are the days when a taxonomist could make species calls right and left in blissful isolation, ignored by anyone but another taxonomist. Nowadays you might find yourself having to defend the validity of your new species in a lawsuit, or at least in front of the California Fish and Game Commission.

The resultant interplay between academic and non-academic botanists manifests itself in several ways in California. Academia continues to be the primary source of expertise and training needed by non-academic botanists, and the herbarium itself is an important source of fundamental taxonomic information that serves as a bridge between academic and non-academic interests. At the same time, as it did in the days of Linnaeus, Torrey, and Gray, academia still depends on the efforts of outside collaborators, who are simultaneously the main consumers of taxonomic products such as new species descriptions, keys, and floras. This includes computerized incarnations that comprise yet another *New Face of California Botany*.

As a primary example of collaboration, consider one of the most recent floristic efforts, the revised Jepson Manual (Hickman 1993), of which the first printing of 7,000 copies sold out in only 3 months.

For background, the terms of Jepson's endowment to the University of California stipulated that the original Jepson Manual (Jepson 1925) be updated and that his multi-volume Flora of California be completed. However, the activities necessary to meet these terms were not compatible with professional advancement, so neither Manual nor Flora were priority items for subsequent endowment-funded curators.

To become a reality, the Jepson Manual Project depended largely on grass-roots funding from non-academic sources within California, with mainstream NSF funding only at the tail end. And the funding provided only for the infrastructure, the editing and coordinating of treatments provided by nearly 200 unpaid contributors who provided the bulk of the actual text. As a rough calculation, only about half of these contributors were faculty or research staff at academic institutions, and this is including emeriti, non-systematists, and faculty at colleges too small to have an adequate herbarium. The remainder consisted of non-academic staff, consultants, agency botanists, students, and miscellaneous contributors, all of whom prepared treatments on their own time (as, for that matter, did many of the faculty and research staff).

As a second example of collaboration, consider the most fundamental contribution to conservation that taxonomists make: the initial recognition of previously unknown taxa. At present, new plant species in California are perhaps more likely to be discovered and described by agency botanists, environmental consultants, horticulturalists, and native plant enthusiasts than by academic botanists. For example, academia cannot take credit for the recent headline-making discovery of the Shasta snow-wreath, *Neviusia cliftonii* (Shevock et al. 1993), but at the time there were no academic systematists specializing on the California flora at any of the major herbaria in California. The discovery itself was by two consultants, while the senior author was a forest service botanist.

The snow-wreath collaboration continued through the following year, with an announcement that anyone wanting to assist in the search for new populations should congregate at a group campground that had been reserved by the local forest service botanist (Shevock 1993). The forest service also provided a boat to ferry participants across Shasta Lake. Nearly 50 botanists showed up, mostly agency botanists and consultants on busman's holiday. As a result, five new populations were discovered, bringing the total known to eight.

This kind of distributional data is one more example of taxonomic information that is relevant to conservation, as a key to determining what plants are rare enough to deserve special consideration. In California, the primary published summary of rare plants is the California Native Plant Society's "Inventory of Rare and Endangered Vascular Plants of California" (Skinner and Pavlik 1994). In

addition to the personal expertise of numerous collaborators, both academic and non-academic, one of the greatest sources of information for this on-going effort has been the collective holdings of California herbaria. However, the millions of specimens comprising the collective holdings of herbaria worldwide, overwhelming as they are, nevertheless are only an erratic sampling of actual distributions. Often they are more an indication of who collected where than what grows where, as proven by how long *Neviusia cliftonii* remained undiscovered.

Distributions compiled from existing herbarium specimens are sometimes inadequate in another way, as illustrated by *Horkelia cuneata* Lindley ssp. *puberula* (Greene) Keck. It is not currently on any rare plant list, largely because there are plenty of herbarium specimens of the taxon. However, most of these specimens are from the Los Angeles Basin, which should quickly alert anyone familiar with the area that the current distribution may be decidedly otherwise. Nobody has checked to see how many historical records still represent extant populations; I suspect that the subspecies may be in serious danger.

A final example of the political, economic, and legal ramifications of taxonomic decisions, and the way that taxonomists are being called into the fray, is the case of *Chorizanthe robusta* C. Parry var. *hartwegii* (Benth.) Rev. and R. Morgan. When the California Native Plant Society petitioned the U.S. Fish and Wildlife Service to have the variety emergency-listed, the consulting botanist who had encountered some on a proposed development site countered that the variety was actually a trivial variant in a species that had been too finely split.

The Fish and Wildlife Service did not have the expertise to break the impasse on their own. What they did instead was arrange to have three taxonomists (Lincoln Constance, Larry Heckard, and myself) spend a day examining all relevant material. Our conclusion was that the variety was indeed so weakly delimited as to sit right on the cusp of being worth naming or not. We bypassed the problem, however, by noting that most of the known populations of *C. robusta* as a whole had been extirpated, as had those of the closely related *C. pungens* Benth. We therefore recommended that the entire complex be petitioned for listing. This is, in fact, the course that was taken, and as a result all varieties of both species have recently been Federally Listed.

In summary, the latest face in the ever-changing face of California botany is that of a developing partnership between academic botanists, non-academic professionals, and native plant enthusiasts. I deeply believe that such regional, collaborative efforts are integral parts of any realistic solution to the numerous environmental problems that are besetting us. In this regard, I can think of no more

appropriate ending for this symposium paper than to quote Jepson himself at the founding of the California Botanical Society (Anon. 1916):

A botanical society, said Dr. Jepson, ought to have two aims—the promotion of botanical research, and the diffusion of accurate botanical knowledge, in an accessible form, amongst the people. Botany should not be the property of a small cult or a select few, but it should be a science with a broad outlook in its relation to other sciences and to the humanities. It should play its due part in the progress of civilizations in California.

With any such end in view botanical science, for its proper development, must have the support of the people of California, with such support accorded, the people of California are entitled to have at their command the best results of recent botany in a form suited to their needs.

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